ВикипедиЯ

Popov, Alexander Stepanovich

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Aleksander Stepanovich Popov (March 4 [16], 1859 , Turinsky mines , Perm province - December 31, 1905 [January 13, 1906] , St. Petersburg [1]) - Russian physicist and electrical engineer, professor, inventor , state adviser (1901), Honorary electrical engineer (1899). Inventor of the radio .

Alexander Stepanovich Popov

Rector of the St. Petersburg Imperial Electrotechnical Institute Alexander III

1905 - 1906

Predecessor	Kachalov, Nikolai Nikolaevich
Successor	Voinarovsky, Pavel Dmitrievich
Birth	March 4 (16), 1859 Turyinskiye Mines , Verkhotursky Uyezd , Perm Province , Russian Empire
Death	December 31, 1905 (January 13, 1906) (46 years old) Saint Petersburg , Russian Empire [1]
Burial place	Literary bridges
Education	Faculty of Physics and Mathematics, St. Petersburg University
Academic degree	candidate of physical and mathematical sciences
Profession	uchonyy- physicist
Activities	physics

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Biography

Alexander Stepanovich Popov was born on March 4 (16), 1859 , in the settlement at the Theological Plant, the Turinsky Mines of the Verkhotursky Uyezd of the Perm Province , now the city of Krasnoturinsk , the administrative center of the Krasnoturinsk City District of the Sverdlovsk Region [2] .

In the family of his father, the priest of the Maximov church of the Turin mines, Stefan Petrov Popov (1827-1897), besides Alexander there were 6 more children, among them Augusta , a future famous artist. Lived more than modestly. The cousin of the future inventor Pavel Popov occupied the professorship at Kiev University , and his son Igor Popov (1913-2001) became an American seismologist [3] .

Details of the relatives of A. S. Popov

- Отец — Стефан Петров Попов (1827—1897). Родился 27 июня (9 июля) 1827 года в с. Рождественском (Сылвинское, Каширино) Рождественской волости Кунгурского уезда Пермской губернии. В 1846 году окончил Пермскую духовную семинарию по второму разряду. Преосвященным Аркадием (Федоровым), архиепископом Пермским и Верхотурским, был рукоположен в сан священника к Никольской церкви с. Пихтовское Оханского уезда. С 1855 г. переведён настоятелем Максимовской церкви с. Турьинские рудники Богословского округа Верхотурского уезда Пермской губернии (ныне г. Краснотурьинск). С 1861 по 1870 гг. преподавал Закон Божий в бесплатной школе для девочек, открытой в его собственном доме. Награждён бронзовым наперстным крестом в память о войне 1853—1856 гг., золотым напёрстным крестом из кабинета Святейшего Синода. Многократно избирался депутатом по судебным делам. В 1881 году переведён в Богословский завод настоятелем церкви святого апостола Иоанна Богослова, где провёл последние годы жизни. Скончался 20 февраля (4 марта) 1897 года . Погребён за алтарём Иоанно-Богословского храма.
    - Дед — Пётр Николаев Попов (1785—1860), был священником Спасо-Преображенского храма с. Рождественское Кунгурского уезда Пермской губернии (ныне с. Сылвенское).
        - Прадед — священник Николай Петров Попов, служил в одном из храмов г. Кунгура, сын священника.
- Мать — Анна Стефанова Пономарёва (25 июля (6 августа) 1830, с. Шогриш Ирбитского уезда — 1903, Пермь), седьмой ребёнок в семье Стефана Иоаннова Пономарёва (1795—?), который в 13-летнем возрасте, в 1808 году, был посвящён в стихарь и оставлен на должности псаломщика. Овдовев, женился вторично, за что епархиальной властью ссылался на покаяние в Верхотурский Свято-Николаевский мужской монастырь. Служил в Никольском храме до 1858 г., после чего был выведен за штат.
    - Прадед А. С. Попова, протоиерей Иоанн Гавриилов Пономарёв (1767-?), служил настоятелем Свято-Никольской церкви в с. Шогриш Ирбитского уезда. Известно, что всю свою жизнь он посвятил строительству каменного храма в этом селе.
- Брат Рафаил (1849—1913), преподавал латинский язык
- Сестра Екатерина (1850—1903)
- Сестра Мария (1852—1871), в замужестве Левитская
- Сестра Анна (1860—1930), врач
- Сестра Августа (1863—1941), в замужестве Капустина — художница, ученица И. Репина.
- Сестра Капитолина (1870—1942)

Autograph	
Awards	Prize of the Imperial Russian Technical Society
	Scientific activity
Scientific field	physics and electrical engineering
Place of work	St. Petersburg Electrotechnical University

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Monument to the inventor of radio A. Popov in Yekaterinburg

Жена — Раиса Алексеевна Богданова (28 мая (9 июня) 1860—1932), дочь присяжного поверенного. Венчание состоялось 18 ноября 1883 года в церкви Косьмы и Дамиана лейб-гвардии сапёрного батальона. С ней А. С. Попов познакомился, готовя её к поступлению на Высшие женские медицинские курсы при Николаевском военном госпитале. По окончании курсов (1886 г. второй выпуск) она стала одной из первых в России дипломированных женщин-врачей и всю жизнь занималась врачебной практикой[4] в удомельской больнице.

- Сын Степан (15 октября 1883—1920), один из организаторов и первых преподавателей Удомельской средней школы (им. А. С. Попова), служил в Красной Армии, умер в Ростове-на-Дону от тифа.
- Сын Александр (25 февраля (9 марта) 1887—14 января 1942), работал в Горстройпроекте г. Ленинграда[5]. Жена Зинаида Николаевна (1904—1984)
- Дочь Раиса (24 июня 1891—1976), врач. Муж Андреев Владимир Гаврилович, дочь Мария Владимировна (1921—1995), есть правнуки.
- Дочь Екатерина Попова-Кьяндская (16 января 1899—1976), Заслуженный работник культуры РСФСР. Муж Георгий Александрович Кьяндский (1895—1955), дочь Екатерина Георгиевна (1934—1994)

Крёстным отцом детей Александра Попова был прот. Иоанн Кронштадтский[6]

At the age of 10, Alexander Popov was sent to the Dalmatian Theological School , in which his older brother Rafail taught Latin, where he studied from 1868 to 1870 [7] . In 1871, Alexander Popov transferred to the third grade of the Yekaterinburg Theological School . [8] At that time, his elder sister Maria Stepanovna lived in Yekaterinburg with her husband, priest Georgy Ignatievich Levitsky. [9]The father of the latter - Ignatius Aleksandrovich Levitsky - was a very wealthy man (had three houses in the city) and held a responsible post in the diocesan school board. In 1873, A. S. Popov graduated from the full course of the Yekaterinburg Theological College in the highest 1st category.

In 1873 he entered the Perm Theological Seminary . After graduating from general education classes at the Perm Theological Seminary (1877), Alexander successfully passed entrance exams at the Physics and Mathematics Department of St. Petersburg University . The years of study at the university were not easy for Popov. There were not enough funds, and he was forced to work as an electrician in the office of Electrotechnician. During these years, Popov's scientific views were finally formed: he was particularly attracted to the problems of modern physics and electrical engineering.

Having successfully graduated from the university in 1882 with a candidate’s degree, A. S. Popov was invited to stay there to prepare for professorship at the Department of Physics. In 1882 he defended his thesis on "On the principles of magneto-and dynamoelectric DC machines." But the young scientist was more attracted to experimental research in the field of electricity, and he enrolled as a teacher of physics , mathematics, and electrical engineering at the Mine Officer Class in Kronstadt , where he had a well-equipped physical room. In 1890 he received an invitation to the post

of physics teacher at the Technical School of the Maritime Departmentin Kronstadt. At the same time, in the summer of 1889–98, he headed the main power plant of the Nizhny Novgorod Fair in the summer. During this period, Popov devotes all his free time to physical experiments, mainly the study of electromagnetic waves . In 1899 he was awarded the title of Honorary Electrical Engineer.

Since 1901, Popov is a professor of physics at the Electrotechnical Institute of Emperor Alexander III . Popov was also an Honorary Electrical Engineer (1899) [10] and an Honorary Member of the Russian Technical Society (1901). In 1901, Popov was assigned the civil (state) rank of class V state counselor .

In 1902, A. S. Popov was elected an honorary member of the Imperial Russian Technical Society (IRTO), and in 1905 - chairman of the Physics Department and president of the Russian Physicochemical Society (RFHO), which he was to occupy since January 1, 1906. .

In 1905, the academic council of the institute elected A. S. Popov as rector . In the same year, Alexander Stepanovich Popov bought a cottage on Lake Kubycha , three kilometers from the Udomlya station , where his family lived for many years after the scientist’s death [11] .

Alexander Stepanovich Popov suddenly died on December 31, 1905 (January 13, 1906) from a stroke [12] . He was buried at the Literary bridges of Volkov (now Volkovsky) cemetery [13] in St. Petersburg .

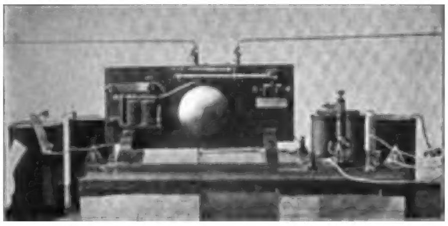
The grave of A. S. Popov on the Literary bridges of the Volkovsky cemetery in St. Petersburg

On January 3, 1906, Petersburg newspaper published an obituary: “On the last day of old 1905, Russia lost one of its prominent people. Died A. S. Popov, director of the Electrotechnical Institute, died relatively young, at the 47th year of his life, spent in relentless scientific work. Russia can be proud of him as the inventor of the wireless telegraph, although alas, the ill-fated fate of Russian inventors was fulfilled on it too ...

In 1921, the Council of People's Commissars of the RSFSR decided (on the proposal of Prof. V.P. Vologdin at the first All-Russian Radio Engineering Congress in Nizhny Novgorod) to provide A. Popov's family with a life-long welfare [14] .

Scientific research Popov

A.S. Popov's ship radio station of the 1901 model was designed for reception by tape and by ear. Many of the ships of the Black Sea Fleet were equipped with such receiving stations . During general naval maneuvers on September 7, 1899, they managed to maintain radio communication with the ships " George the Victorious ", " Three Saints " and "Captain Saken", which drifted 14 km from the coast. In memory of this, it was called Radio Mountain in Sevastopol .


Lightning detector Popov (photo from the publication of 1907)

The device of A. S. Popov arose from the installation for the educational demonstration of Hertz’s experiments , built by A. S. Popov with educational purposes in 1889; Hertz's vibrator served as a scientist transmitter. At the beginning of 1895, A. S. Popov became interested in the experiments of O. Lodge [15] (who improved the coherer and built a radio receiver on its basis , with which he was able to receive radio signals from a distance of 40 m in August 1894), and tried to reproduce them by building his own modification of the lodge receiver.

The main difference between the Popov receiver and the Lodge receiver was as follows. Coherer Branly -Lodge was a glass tube filled with metal filings that could dramatically - several hundred times - change their conductivity under the influence of a radio signal. To bring the coherer to its original state for detecting a new wave, it was necessary to shake to break the contact between the sawdust. At the Lodge, an automatic drummer was attached to the glass tube, which hit him constantly; A. S. Popov introduced automatic feedback into the circuit : a relay was triggered from the radio signal, which turned on the bell, and at the same time a drummer was triggered, striking a glass tube with sawdust [16] . A. S. Popov used in his experimentsa grounded mast antenna , invented in 1893 by Tesla [16] .

He first presented his invention on April 25 (May 7, according to a new style) in 1895 at a meeting of the Russian Physicochemical Society in the building of "jeu des Pom" (ball game) in the courtyard of St. Petersburg University . The topic of the lecture was: "On the relation of metal powders to electric vibrations". Until recently, it was mistakenly believed that the first publication describing the wireless telegraph was the publication of the minutes of the 15th meeting of this meeting - in the December issue of 1895 of the RFHO journal [17](The actual state of affairs is discussed below, in the part devoted to priority). In the published description of his instrument, A. S. Popov noted its use for lecture purposes and recording perturbations occurring in the atmosphere; he also expressed the hope that "with further improvement of it, my device can be applied to transmitting *<in fact - to receiving>* signals over distances using fast electrical vibrations, as soon as a source of such vibrations with sufficient energy is found" (later , from 1945 this event will be celebrated in the USSR as Radio Day) Work in the Maritime Department imposed certain restrictions on the publication of research results, therefore, in compliance with this oath promise of non-disclosure of information constituting classified information, Popov did not publish new results of his work [18] .

A. S. Popov connected his device with the writing coil of the Richard brothers and thus received a device for recording electromagnetic oscillations in the atmosphere; Having learned after a meeting of the RFHO about this modification from his assistant G. A. Lyuboslavsky, a student of Alexander Stepanovich, the founder of the Physical Department of the Forestry Institute D. A. Lachinov was the first to install a "lightning detector" (or "discharge detector" - he was the first to give such names to the device) his weather station, where he received the first registration of electrical discharges of the atmosphere. However, when the first information about the invention of the Marconi wireless telegraph appeared in print (he demonstrated the transmission of radiograms over 3 km on September 2, 1896) - A. S. Popov began to make claims that the priority in wireless telegraphy belongs to him, and that his device is identical to the Marconi device. Nevertheless, on October 19 (31), 1897, Popov said in a report at the Electrotechnical Institute: "A telegraph device has been assembled here. We were unable to send a connected telegram, because we had no practice, all the details of the devices still need to be developed. " On December 18, 1897, using the telegraph apparatus attached to the device, Popov conveyed the words: "Heinrich Hertz". The receiver was located in the physical laboratory of St. Petersburg University, and the transmitter was in the building of the chemical laboratory at a distance of 250 m. In the literature, however, it is alleged that this experiment was performed on March 24, 1896(that is, before Marconi's application). The minutes of this meeting said only: "... 8. A. S. Popov shows instruments for lecturing demonstration of the experiments of Hertz ...". [16]

However, a note about an experiment conducted on April 25, 1895 during a report at a meeting of the Russian Physicochemical Society at St. Petersburg University in transmitting radio signals over a distance without wires with a full description of the experiment itself was published in the newspaper Kronshtadtsky Vestnik on 04/30/1895 (genuine the receiver and a note from the "Kronstadt Gazette" can be seen in the Central Populist Center named after A. S. Popov in St. Petersburg).

Since 1897, Popov conducted experiments on radio telegraphy on the ships of the Baltic Fleet. In the summer of 1899 , when Popov was in Switzerland, his assistants - P.N. Rybkin , D.S. Troitsky and A.A. Petrovsky - accidentally discovered when working between the two Kronstadt forts that the coherer at a signal level insufficient for it excitation, converts the amplitude-modulated high-frequency signal into a low - frequency signal, so that its signals can be received by ear. When this was reported, Popov modified his receiver by replacing the sensitive relay with handsets, and in the summer of 1901 received the Russian privilege No. 6066, group XI, with priorityJuly 14 (26), 1899 to a new (linear-amplitude) type of "telegraph receiver of dispatches sent using any source of electromagnetic waves via the Morse system."

After that, the company Ducrete , already producing receivers of its design in 1898, launched the production of telephone receivers. Among the first ships equipped with Popov's wireless telegraph was the Yermak icebreaker .

Only in December 1901 at the XI Congress of Naturalists and Doctors the merits of A. S. Popov were recognized by representatives of scientists from all over the world, and even Marconi himself kindly left the primacy of the invention for him. But these generous confessions of the “European inventor” did not extinguish any of the rays of the fame he obtained and did not add the beam to the glory of the Russian professor ... Russian people overlooked, as usual, their compatriot, waited for such an invention abroad, and A. Popov, probably I read with bitterness in my heart how not only the foreign, but also the domestic press in all respects praised the belated inventions of a foreigner, despite the fact that in the affairs of one of the Russian special societies this invention was already registered for Russian man, behind A. S. Popov.

The question of Popov’s priority in inventing radio

The first report on the "Popov Discharger". July 1895 [19]

In many Western countries, Marconi is considered the inventor of radio [20] , although other candidates are also called: in Germany , Hertz is considered the creator of the radio , E. Branly in France , Nicola Tesla in a number of Balkan countries , and J. O. Narkevich-Iodka in Belarus . The statement about Popov’s priority is based on the fact that Popov demonstrated the radio receiver he invented at a meeting of the Physical Department of the Russian Physicochemical Society on April 25 (May 7), 1895 , while Marconi applied for the invention on June 2, 1896. In Russia, this is accompanied by direct or indirect accusations of plagiarism by Marconi: it is assumed that his works of 1895 were not reflected anywhere (more precisely, they are known only from persons close to him, whose impartiality is considered doubtful in Russia), at the same time in the application he used a scheme similar to the Popov receiver, the first description of the prototype of which was published in July 1895 with the release of the 2nd edition of the Fundamentals of Meteorology and Climatology by D. A. Lachinov, which sets out the principle of operation of the “Popov Discharger” [19] [21]] [22] [23]Popov himself, from the beginning of 1897 (that is, with the appearance of the first newspaper reports about Marconi's successes), began to actively defend his priority, supported by relatives and colleagues in this. In the 1940s in the USSR, its priority (including among scientists) was considered indisputable.

May 7 has been declared Radio Day in the USSR since 1945 . In 1995, UNESCO held a solemn meeting dedicated to the centenary of the invention of radio. The board of directors of the Institute of Electrical and Electronics Engineers (IEEE) noted the demonstration of A. S. Popov as a milestone in electrical and radio electronics. [24] An article in the History section of the IEEE official website claims that A.S. Popov was indeed the first, but was forced to sign a non-disclosure agreement related to teaching at the Marine Engineering School. [18] [24] On the Milestone plaque"An inscription was written that read:" Contribution of A. S. Popov to the development of telecommunications, 1895. On May 7, 1895, A. S. Popov demonstrated the possibility of transmitting and receiving short and long signals up to 64 meters by means of electromagnetic waves using a special portable device "which responded to electrical vibrations, which has become a decisive contribution to the development of wireless communications." A similar plaque is installed in Switzerland. It testifies that Marconi began his experiments on wireless telegraphy on September 25, 1895. [18]

Popov’s priority is also justified by the fact that on March 25, 1896 (that is, two months before Marconi’s application) he carried out experiments with wireless telegraphy, connecting his apparatus with a telegraph and sending a radiogram of two words to a distance of 250 m: “Henry Hertz”. At the same time, they refer to the memoirs of relatives of Popov, as well as to the report of Professor V. V. Skobeltsyn at the Electrotechnical Institute dated April 14, 1896 “A. S. Popov's Instrument for Recording Electrical Oscillations”. The report (appearing before Marconi's first patent) explicitly states:

“In conclusion, the speaker made an experiment with the Hertz vibrator, which was placed in a neighboring wing on the opposite side of the yard. Despite the considerable distance and the stone walls located on the path of the propagation of electric rays, with every signal by which the vibrator was driven, the device rang loudly. ”

The record refers to a meeting of the Russian Physicochemical Society on March 24, 1896; the record clearly states that it was precisely signals that were transmitted by Popov to a considerable distance, that is, in fact, this was the very device that would be patented by Marconi in a few months.

However, already in the minutes of the meeting on March 25 it was said: “A. S. Popov shows instruments for the lecture demonstration of Hertz’s experiments. ” October 19/31, 1897 (that is, after the creation of the Marconi radio station, transmitting 21 km) Popov said in a report at the Electrotechnical Institute: “Here is a telegraph device. We were unable to send a connected telegram, because we had no practice, all the details of the devices still need to be developed. ” The transfer of the first radio telegrams Popov, according to documentary evidence, there was 18 December 1897 city of [16]

Proponents of Popov’s priority indicate that:

- Popov was the first to demonstrate a practical radio (May 7, 1895).
- Popov was the first to demonstrate the experience of radiotelegraphy by sending a radiogram (March 24, 1896).
- Both that and another happened before Marconi's patent application.
- Popov's radio transmitters were widely used on ships.

Critics object to this, that:

- There is no documented evidence that Popov tried to seriously engage in the introduction of wireless telegraphy until 1897 (that is, before he learned about the work of Marconi).
- In his lecture (topic of the lecture: “On the relation of metal powders to electric vibrations”), Popov did not address the issues of radio telegraphy and did not even try to adapt a radio receiver for it (the device was adapted to capture atmospheric phenomena and received the name “lightning detector”).
- Popov's goal was to improve the experiments of O.D. Lodge , and his radio was an improved modification of the lodge coherency receiver.

Popov's laboratory in Kronstadt

Proponents of Popov’s priority, however, explain the lack of documentary evidence of Popov’s experiments with radio telegraphy until 1897 (contemporary to the experiments themselves, and not in later memoirs) by the fact that since Popov served in the naval department, his experiments were military, and therefore secret, in the documents reflected intentionally vaguely.

Thus, according to some critics, the “father” of radio in the broad sense of the word is Hertz, the “father-distributor” of radio telegraphy is Marconi, who adapted the Hertz transmitter and receiver of Popov to the practical task of transmitting and receiving radio telegrams by connecting the first with a telegraph key, and the second with a printing telegraph apparatus. But in general, the question of the invention of radio in general (and not of radio telegraphy and other specific forms of its application) in Nikolsky's opinion is just as ridiculous as the question of the "invention" of gravity [16] [25] [26]

Soviet propaganda represented Popov as the sole inventor of radio, and he was consciously silent about Marconi and his inventions. For example, in the Soviet Encyclopedic Dictionary of 1955 there is no article about Marconi, but about Popov it says: *"Radio was invented by the Russian scientist A. S. Popov in 1895"* [27] . In Soviet literature, Popov is also credited with the invention of the antenna , [28] although Popov himself wrote that "the use of the mast at the departure station and at the reception station for transmitting signals using electrical vibrations" is the merit of Nikola Tesla . [16] The creation of the coherer was also attributed to Popov. [29] Moreover, not only the experiments of Oliver Lodge, but his very existence was hushed up, as were Tesla's early experiments . So, in the 3rd edition of TSB , Tesla's work in the field of radio is dated back to the era after Popov: *"T.'s work on wireless signal transmission in the period 1896-1904 (...) had a significant impact on the development of radio engineering."* [30]

In the polemic about the priority of Popov or Marconi, the fact that the first demonstration of the effect of the excitation of oscillations at a distance was made in 1879 by David Hughes (inventor of the printing telegraph and microphone), who recorded electromagnetic effects at a distance of half a kilometer, is also completely silent. In 1880, he demonstrated the operation of his device to members of the Royal Academy of Sciences. In 1888, a similar effect was demonstrated by Heinrich Hertz.

Awards and prizes

- Order of St. Anne of the 2nd degree (1902)
- Order of St. Stanislav 2nd degree (1897)
- Order of St. Anne of the 3rd degree (1895)
- Medal "In memory of the reign of Emperor Alexander III"
- In the summer of 1900, the World Industrial Exhibition took place in Paris , which demonstrated the action of the A. Popov light-throw detector manufactured in the Kronstadt workshop of E. V. Kolbasyev and the ship radio station manufactured by the Parisian firm Ducreté under the brand name "Popov-Ducreté-Tisso" . Popov as a participant in the exhibition was awarded a nominal gold medal and diploma.
- By the highest decree, he received a reward of 33 thousand rubles for the continuous work on the introduction of a wireless telegraph in the navy (April 1900)
- IRTO Prize "for a receiver for electrical oscillations and devices for telegraphing at a distance without wires" (1898).

Memory

The name of A. S. Popov is the small planet (No. 3074) , the crater on the far side of the moon , museums, educational institutions, institutes, enterprises, streets, motor ship, prizes, medals, diplomas. He erected at least 18 monuments and busts in Russia and abroad. Since 1945, the USSR Academy of Sciences has awarded the Gold Medal named after A. S. Popov for achievements in the development of methods and means of radio electronics. Six museums are engaged in perpetuating the memory of the inventor:

1. Museum of Radio named after A. S. Popov in Yekaterinburg
2. Museum of Radio named after A. S. Popov in Omsk
3. The house-museum of Alexander Stepanovich Popov in Krasnoturinsk
4. Memorial Museum of the radio inventor A.S. Popov in Kronstadt [31]
5. Museum-cabinet and museum-apartment of A. S. Popov in St. Petersburg (based on LETI)
6. Central Museum of Communications named after A.S. Popova in St. Petersburg
7. On May 7, 1999, at the end of the main avenue of the Matrossky Boulevard in Sevastopol, near the place where the Signal Mast radio station was located at the beginning, a commemorative sign "In honor of the invention of the radio by A. S. Popov" was opened, built at the expense of the Black Sea Fleet of the Russian Federation , management culture and Sevtelecom Sevastopol designed by Honored Architect of Ukraine A. L. Sheffer.

Addresses of Alexander Stepanovich Popov

Адрес в Екатеринбурге, где жил А. С. Попов:

- 1871—1873 — Екатеринбург, ул. Р. Люксембург, 9/11

Адреса в Санкт-Петербурге, где работал А. С. Попов:

- 1886—1898 — Кронштадт, Песочная улица, 31
- 1898—1901 — Кронштадт, Посадская улица, 35
- 1901—1902 — Санкт-Петербург, Тучкова набережная, 22
- осень 1903 — 31.12.1905 — Санкт-Петербургский Императорский электротехнический институт Александра III — Санкт-Петербург, Песочная улица, 5

Monument in honor of the centenary of the invention of radio in Sevastopol

Works

- *A. Popov.* Collection of documents: On the 50th anniversary of the invention of radio. The collection was prepared by the archival department of the UNKVD in the Leningrad region. Compiled by G.I. Golovin and R.I. Karlin. Edited by M. A. Chatelene, I. G. Klyatskin, V. V. Danilevsky., L.: Lenizdat, 1945. [1] (http://publ.lib.ru/ARCHIVES/P/POPOV_Aleksandr_Stepanovich/_Popov_A.S..html)
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Notes

↑ Show compactly

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Links

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Источник — https://ru.wikipedia.org/w/index.php?title=Попов,_Александр_Степанович&oldid=103087386

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